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CONE BEAM COMPUTED TOMOGRAPHY (CBCT) FOR DETERMINING MIDPALATAL SUTURE MATURATION: A CASE REPORT

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ABSTRACT

In orthodontics and dentofacial orthopedics, the timing of the treatment onset is as critical as the selection of the specific treatment protocol. The issue of optimal timing is linked to the periods of accelerated growth contributing significantly to the correction of skeletal imbalances. Skeletalmaturity can be assessed by several biologic indicators: increase in body height, hand-wrist radiograph, dental development and eruption, menarche or voice changes, and cervical vertebral maturation (CVM).

The start and the advance of fusion of mid palatal suture varies greatly with age and sex, in which late adolescent or young adult patient can have rapid maxillary expansion (RME) as a less invasive alternative to surgically assisted expansion.

Cone-beam computed tomography (CBCT) gives 3-dimensional images of the oral and maxillofacial structures at low cost, no superimposition of adjacent structures, easy accessibility and low radiation exposure.

This case report describes the use of CBCT as an accurate diagnostic aid adjunct to different skeletal maturity indicators in a patient requiring RME.

KEYWORDS: CBCT, CVM, Hand-Wrist Radiograph, Occlusal Radiograph & RME

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A Case Report

INTRODUCTION

In orthodontics and dentofacial orthopedics, the timing of the treatment onset is as critical as the selection of the specific treatment protocol. The issue of optimal timing for dentofacial orthopedics is linked intimately to the identification of periods of accelerated growth that can contribute significantly to the correction of skeletal imbalances in the individual patient. Individual skeletal maturity can be assessed by means of several biologic indicators: increase in body height, skeletal maturation of the hand and wrist, dental development and eruption, menarche or voice changes, and cervical vertebral maturation.

Rapid maxillary expansion (RME) has been used in orthodontic practice for the correction of posterior cross bite and dental crowding as well as to facilitate correction of Angles Class II (**Guest*et al.* 2010**) and Class III

(**Da Silva Filho Magro *et al*. 1998**) malocclusions, with the overall objective to widen the maxilla by separating the mid palatal suture and the circum maxillary suture system.

The start and the advance of fusion of mid palatal suture vary greatly with age and sex. The mid-palatal suture has been described as an end-to-end type of suture with characteristic changes in its morphology during growth. In the infantile period, Melsen reported that the midpalatal suture is broad and Y- shaped in its frontal sections. Persson and Thilander(1997)observed fusion of the mid-palatal suture in subjects from 15 to 19 years of age. On the other hand, patients at the ages of 27yrs **(Persson & Thilander 1997),**32yrs **(Persson & Thilander 1997)**, 54yrs (**Knaup *et al.*2004),** and even 71yrs **(Korbmacher*et al.* 2007)**have been reported to have no signs of fusion of this suture. Such findings indicate that the variability in the developmental stages of fusion of the mid-palatal suture is not related directly to chronologic age, particularly in young adults.

For this reason, **Revelo and Fishman (1994)** proposed individual assessment of the mid palatal suture morphology with occlusal radiographs before RME therapy. However, occlusal radiographs were not reliable for analyzing midpalatal suture morphology, because the vomer and the structures of the external nose overlay the mid palatal area, and thus might lead to false radiographic interpretations of mid-palatal suture fusion. (**Wehrbein & Yildizhan 2001).**

The Cervical Vertebral Maturation (CVM) method is performed on lateral cephalograms that are used routinely for orthodontic diagnosis and treatment planning, avoiding the need for an additional radiograph (**Baccetti*et al.*2005**). This method has demonstrated reliability and reproducibility for evaluating the pubertal peak and further maturation in skeletal growth (**Perinetti *et al.*2014**).

Cone-beam computed tomography (CBCT) provides 3-dimensional images of the oral and maxillofacial structures at relatively low cost, no superimposition of adjacent structures, easy accessibility and low radiation exposure compared with multi-slice medical computed tomography. **Angelieri *et al* (2013)**proposed 5 maturational stages of the mid-palatal suture: stage A, straight high density sutural line, with no or little interdigitation; stage B, scalloped appearance of the high-density sutural line; stage C, 2 parallel, scalloped, high-density lines that are close to each other and are separated in some areas by small low-density spaces; stage D, fusion completed in the palatine bone with no evidence of asuture; and stage E, complete anterior fusion in the maxilla.“Figure 1 and 2”

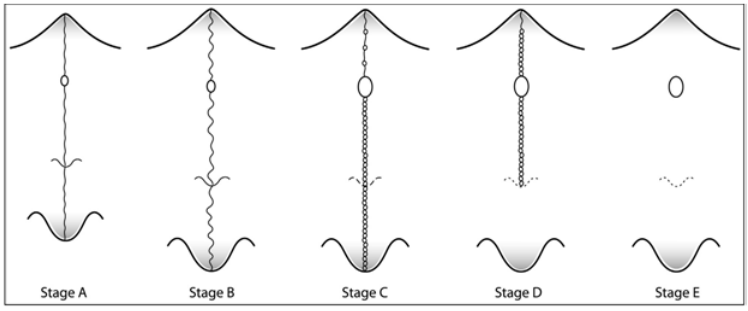

Figure 1: Maturation Stages Observed in the Midpalatal Sutur

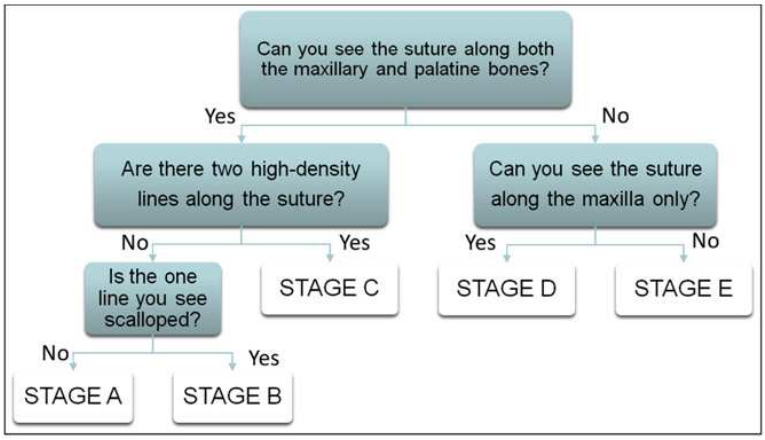

Figure 2: Decision Tree for Classification of the Maturation Stages of Mid Palatal Suture

Understanding individual variability in the fusion of the mid palatal suture is essential in identifying prospectively, which late adolescent or young adult patient can have RME as a less invasive alternative to surgically assisted expansion.

This case report describes the use of CBCT, as an adjunct to different skeletal maturity indicators in a patient requiring Rapid Maxillary Expansion.

CASE REPORT

A 14 yr old girl had come with a complaint of forwardly placed lower jaw. On extra oral examination, patient had a dolicocephalic head shape, leptoprosopic facial form, concave profile, straight divergent and acute nasolabial angle. On functional examination, no abnormality was seen. On intra oral examination, all soft tissues and hard tissues were normal. Maxillary arch was constricted while mandibular arch was broad. Molar, canine and incisal relationship were Class III on the both right and left side, and there was a reverse over jet of 2 mm and overbite of 2mm. On cephalometric analysis, the patient had a Class III skeletal base with retrognathic maxilla and orthognathic mandible and having an average growth pattern.

Through clinical and cephalometric data, it was concluded that the patient presented with Class III skeletal bases with retrognathic maxilla, orthognathic mandible, vertical growth pattern, Angle's Class III malocclusion with anterior and bilateral posterior cross bite, concave facial profile and competent lips.

The treatment objectives were to expand and protract the constricted maxilla, achieving Class I molar and canine relationship with ideal over jet and overbite.

The treatment chosen was to expand the maxilla followed by reverse pull headgear for maxillary protraction and later fixed orthodontic treatment for final alignment.

Upon analysis of Hand–wrist radiograph, the patient was found to be in the stage of MP3–I stage (the middle phalynx of the middle finger)(**Fishman, 1982**).“Figure 3”

Figure 3: Hand-Wrist Radiograph, MP3-I Stage

Cervical Vertebral Maturation reveals that the patient was in the stage CVMI-6(cervical vertebrae maturation indices)**(Hassel and Farman, 1995).** "Figure 4"

Figure 4: CVMI-6 (Completion Stage)

Hence, the patient had completed her pubertal growth spurt; thereby there was a possibility of the midpalatal suture being ossified, and thus not fit for rapid palatal expansion. ACBCT was advised to further confirm the ossification of midpalatal suture. The data from CBCT was analyzed and compared to the classification proposed by **Fernanda Angelieri (2013).**

The patient was found to be in the stage D, in which the fusion of the midpalatal suture has occurred in the palatine bone, with maturation progressing from posterior to anterior. In the palatine bone, the midpalatal suture cannot be visualized at this stage, and the parasutural bone density was increased (high-density bone) compared with the density of the maxillary parasutural bone. In the maxillary portion of the suture, fusion has not yet occurred, and the suture still can be seen as 2 high density lines separated by small low-density spaces**(Angelieri *et al*. 2013).**"Figure 5"

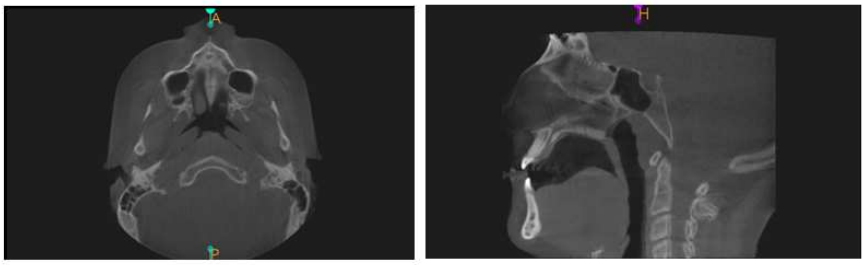

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Figure 5: CBCT Images: 1-Axial View, Stage D is Visualized as 2 Scalloped, High-Density Lines at the Midline on the Maxillary Portion of the Palate The Midpalatal Suture cannot be Visualized in Palatine Bone. 2-Sagittal View

CONCLUSIONS

We have deduced that, even though the pubertal growth spurt has completed according to hand wrist radiograph and cervical vertebral maturation, by analysis of CBCT, midpalatal suture was just beginning to ossify and decided to proceed with rapid palatal expansion.

Hence, CBCT can be a valuable tool for clinical decision between conventional and surgically assisted RME, for adolescent and young adult patients.

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